Notebook, N-04-02-03

This notebook covers the period January 1904-February 1905. It contains notes, primarily by Jonas W. Aylsworth, regarding storage battery experiments. There are additional entries by Edison and by at least one unidentified experimenter. The tests are numbered from 998 through 2204 and pertain to nickel flake for the cells. The entry for test 2195 contains Aylsworth's discussion of reasons for the loss of capacity in the commercial cells, and the tests that follow are attempts to overcome this problem. The front cover is labeled "Storage Battery Experiments #998 to 2204 J W A" and "Somewhat Important." The inside front cover is inscribed "Record of Experiments Edison Storage Battery Co. From Feb 3/04 to ." The pages are unnumbered, and at least one page has been removed from the book. Approximately 190 pages have been used.

Only tests 998-1065, which contain entries by Edison, and tests 2195-2204 regarding the capacity problem have been selected.

Record of Experiments
Edison Storage Battery Co.
From Feb 3/04 to

#798. 36 RA

a

3.82 fine graph. Roll 15 min. wet
3.2 cobr neg cell.

b

3.82 fine graph. Roll 15 min dry
3.2 cobr neg cell

c

3.82 ~~XXX~~ fine graph. carefully TAE
3.2 cobr neg cell

999.

999

Reg Sulphate Nickel crystals powdered
treated with 20% NaOH - hot in excess of
NaOH, made mushy & dried, then washed
hot 4 times, then solution drawn off &
NaOH added & boiled, then washed 4
times hot & finally dried - to paste
& bulky appearance

A. Rolled Wgt. H_2O 842 Recovered graphite
15 minutes rolling = 3 reg cells

B - Finger mixed XX graphite by Edison

1000

Regular old process nickel. served to 1/40 inch about + mixed with recovered graphite
8+2 – 2 drops mixed at 6 y heard moving the graphite slightly moist,

#1001 5-12-0

a 2995

8 + 2 from graphite roll 15 min wet
3.2 clay as add

b 2996

8 + 2 from graphite roll 15 min wet
3.2 cl remove my glass 12 hrs

1002

Acid in buff gum buff 1/2 coarse
graphite & the graphite to change
24 hrs & deliver to T.A.E.

#1003. 53 RQ

(a)

8 1/2 fine graphite roll 15 min with K_2O
3.2 gum dry amount as roll.

(b)

8 1/2 fine graphite roll 15 min with K_2O
3.2 gum dry charcoal 12 hrs

1004.

#955 1/2 through 80 mesh
3.2 of 955 1/2 .32 xx fine graph.

#1005. 63 RQ

graphite + K_2OH

a — ~~stuff plaster~~ —
3.2 gum dry sum req.

b — 4 1/2 1/2 coarse graphite roll 10 min dry
3.2 gum dry. ch. sea.

#1006. 64 RA.

a
stuff plain.
3.2 dry

b
4½ to ½ coarse graph roll 10 min
3.2 dry ch neg.

#1007. 65 RA.

a
stuff plain.
3.2 dry. ch neg

b
4½ to ½ coarse graph roll 10 min dry
3.2 dry ch neg.

1008. 66 RA

a
stuff plain 3.2 neg cell.

b
4½ to ½ coarse graph roll 10 min dry
3.2 neg cell.

#1009 #58 Ra

a

Stuff plain
3.2 gm ch neg –
light pressure crimp.

b

9+1 coarse graphite roll 10 minutes –
3.2 ch neg.

1010

Reg ored NiOH by new process NaOH
Seived through 20 caught on 80,
treated 15 minutes in solution of
Ammonia containing NH4 Sulfate,
then soaked water, washed + dried
8+2 wet rolled 15 minutes
fine graphite

1011

Same no. 1010 but soaked in Solution
30 minutes washed + dried
8+2 Rolled 15 minutes wet.
fine graphite –

1012 -
Same as 1010 but soaked in
Nelly Sulf and Nelly Solution for one
hour coarsed and dried,
842 wet rolled 15 minutes, fine
graphite -

1013. 2/4/04

a 3.2 gud neg KOH & f. of MiOH & indicator found & achieved through no cu. 50.

Put in cell & charge for 7 days at 200 rate
Run at 150

1014 2/4/04

Same as 1013 but in cell of ch 24 hrs & put on to run when Mr Edison is here & give to him when it runs to 1.20 bottle

1014a

1014 taken out of fortite dried & refused. beautiful colors on the granulated stuff.
Run without charge against a charged Fe in cell at 150 rate.

#1015.

Same as 1013 put in cell.
at 24 hrs in 33% KOH
& run in 33%
for second time.

#1016. 2/4/04

Same as 1013 put on
at for a week in 33%.
& run at 150.

1017. TCE.

Anode in sulphuric [illegible]
[illegible] half [illegible]
[illegible]

Anode [illegible] fine graph [illegible]
[illegible] clean [illegible]

8 [illegible] coarse graph [illegible] 2 min [illegible]
[illegible] graph [illegible]

1018.

Same as 1010, but 2 hours in Ammonia + NH_4SO_4 solution then washed dried and put in engine for 1/2 hour then washed + cooled wet put into fresh Am Sulf solution then washed warm water + dried.

842 - wet rolled 15 minutes fine graphite —

1019. 57. Ra.
in C_2O_4 precipitated with graphite
by dissolving 120 mix in H.Cl.
& ppt by Oxalic.
The ppt treated with KOH &
washed & dried.

a

make 3.2 cake of plain stuff.
ch reg as a cell.

b

4.5 of 1019 + 15 gum. fine graphite
roll 10 min dry.
3.2 gm dry. ch reg. as cell.

~~#~~ 1020. #52. Ra.
Double ~~oxalate~~ ppt of ammonia
by ppt by 43% KOH washed
& dried. -

a

8 + 2 mix fine graphite wet H_2O,
3.2 cake dry. roll 15 min.
ch reg as all.

b

8 + 2 mix same as a
3.2 cake ch reg 12 hrs -

1021. 2/5/04

25 gm #126 mix with 20 cc conc H_2SO_4 added & then 10 cc conc HNO_3 & left on hot's over night washed the all out & added to a sol of 10 gm mix treat the same except not washed. The whole fl. by large excess of 20% NaOH. washed ~~once~~ & dried & re washed till free of SO_3. The mix will contain 66% $Li(OH)_2$

a

Plain stuff. 3.2 reg cell.

b

#1021 rolled 10 min moist with ½ cc KOH to 4 gm. 3.8 gm dry.

c

Same as (b) / stuff reverse 12 hrs ~~cold~~ in 5% KOH.

#1022 2/5/04

25 gm $Li(OH)_2$ dissolved in HCl. + 2 gm Bi dissol in ~~HCl~~ water to which was added a little HCl (it didn't dissolve easily + nitric was added) the Bi sol is poured into the Li sol. + the combined sol is poured in to hot conc sol of Oxalic acid containing a little alcohol. The combined oxalates are thrown down ~~at~~ once as a very fine crystalline precipitate. It is washed 4 or 5 times & then treated with large excess of KOH. ~~[illegible]~~ + washed till free of KOH.

a = 3 gm above dried stuff + 1.75 gm coarse graph. roll 15 min wet H_2O. c = 20% graph.

3.2 dry reg cell

b = 3 gm 1022 dry. + 1.3 gm coarse graph. roll 15 min wet KOH. = 30% graph.

3.2 dry reg cell.

c = Same as (b) except wet H_2O. ch reverse 12 hrs in hot 5% KOH. in glass

1022

d

Same 1022 not dried and less
moisture determined = 32% $(NH_4)_2O$
21 gm wet stuff + 1.68 gm xx fine graphite
ignited & dried. = 8.42
yield = 8.75 gm when dry.
Make grind 3.2 gm. stuff put wet in
neg. cell.

e

Same as (d) 3.2 gm ch. recover
in hot 5% KOH for 12 hrs. in glass
Put in cell & ch. neg.

1023 –

Solid Crystals (large) Ni Sulfate.
NaOH 20% poured on heated
& Evap to much – dried –
then washed 4 or 5 times,
then water poured off to a much
& fresh NaOH put in boiled,
Then washed till no NaOH or
Sulphate, dries to aggregate
of very small pieces.
8+2 Rolled 15 minutes, wet,
3.2 fine graphite ~

1024 –

Reg new process NaOH washed on 80 mesh – dry – treated several hours with Ammon double salts (Sulfate) & washed & dried between the two actions. Then dried and placed on filter paper & put over an evap dish containing NH4 Sulfide & turned until black on outside only. There are some pieces not covered the penetration is about 1/10 of whole, dried on paper on hot plate 8 & 2 mixed by hand by strong fine graphite, 3.2 –

1025 Same material put in Bomp just as it is without any graphite ~~[illegible]~~ 2 1/2 gramm

1026 – 200 mesh cliff – Reg Ni by NaOH process – treated with ammonia + NH. Sulfate. Twice + dried Calcined – Wire had weak – took all day – 8+2 Rolled wet fine graphite – 3.2 Rolled 5 minutes –

1027 Same as 1026. But Sulphided on paper by fumes of H_2S NH_4 8+2 fine graphite mixed by finger 3.2

#10.28 58.R.a.

(a)

Roll 4.3 gum #58 with 1 c.c 20% KOH.
dry + make 3.2 cake.
clingy as cell.

(b)

Roll 4.3 gum #58 with 1/2 c.c. 20% KOH.
dry + make 3.2 cake.
clingy as cell. 2263.

#1029 60.R.a.

a

Make 8 x 2 mix fine graph roll 15 min
3.2 cake. very cell.

b

Same 8 x 2 coarse graph roll 15 min
3.2 cake. very cell.

#1030 Ra.

3.6 gm graph. of the 1031 mixed in forte with 1 c.c. 10% KOH, & dried (in vac)².

a.

Plain powdered stuff.
3.2 cake dry light pressure
my cell.

b.

Plain stuff ~~powered~~
3.2 cake dry light pressure
~~[illegible]~~ reversed 12 hrs in
5% KOH in hot plate at 200.

c.

4.5 gm #1030 to 1.5 gm coarse graph
with dry 10 min.
do very as cell.

Not enough stuff.

2/6/04

1031 J.W.C.

Some 1021 final washed is put against a sheet of lin & cloth wrapped around & ~~slated~~ in hot sol for 5 min. then washed 2 changes + a little KOH added & washed more hot. cake 3.4 to allow for lin photo - pressed @ 500-500. cal 82-103-104

#1032.

Some. 989 final washed, 2 cated in a little cuf. in hot sol in glass & stirred with stirring. Heated at 2½ amp for.

1033 —

80 mesh new process. Pt. NaOH process — treated KH Double salts considerable & used for following Experiment, moistened powder dotch 43% KOH till damp then used flake graphite with fines screened out thro 80 mesh, then mixed with spatula in big porcelain glass — it kept granular & with graphite used it could be alone but a big mixing longer time, its not very perfectly coated as big flakes have not much coating power — Dried it out so it felt dry but dried it 20 minutes so it could pass in next experiment 3½ gram Cake — graphite [illegible] — Run Reg

1034 — Same as 1033
but made smoky + semi dried —
it will be put in 1m 1/8 inch
Chunks & probably flowed
although there will be larger
voids to start with

1035 —
[illegible] alternate layers of coarse mel —
1/4 & coarse graph. 6 layers of thin.

1036. 69. RA.

Ni C_2O_3 fd. with graphite & treated with Na. OH. washed twice & dried then washed completely.

a

Grid made 3.2 plain stuff. charges all.

b

Grid made 3.2 plain stuff charge 1.5 line in 5-% hot KOH.

c

Grid made 4.5- to .5 gms. coarse pr. Cache 3.2. Bag cell.
Not enough stuff.

.04
.520

1037 2/8/04

2.82 gms. 200 mesh. Ni OH, hot treated with double double cutter.
This is mixed by V.A.E. with gold leaf. 811 proportion of 7 leaves fine & one leaf left coarse. = .32 gms.
Grid charged my 12 cells.

1038.

Made a mix as follows –
7 gms. #958 + 2 gms xx fine graph –
roll 15 min moist with 1 c.c. 20% KOH.
Then dry at gentle heat & add
1 gm coarse graph. & roll 10 min dry.

a.

3.6 cahn = 2.52 $LiOH_2$
dissolving on cell.

b

3.6 cahn some on a recept. ch. recent.
12 hrs in 5% KOH.

1039. 2211 a

Since #2211 & 2212 changed
Mix opened up & stuff taken
out washed & dried &
good made up. 3.2 cahn –
Reg. cell ch & run reg in 2% KOH.

1040 RA

nitrate of $Ba(OH)_2$ ff. with 5% NH_4OH in the usual & dried.

a

Plain stuff 3.2 Ray cell.

b

4½ to ½ coarse graph. Ray cell 3.2 calc.

c

Plain stuff 3.2 charcoal in 5% KOH hot at 200 in glass.

1041 RA.

a

Plain stuff 3.2 Ray cell.

b

4½ to ½ coarse graph Ray cell 3.2 calc. NOT ENOUGH STUFF.

c

Plain stuff 3.2 calc charcoal in 5% KOH hot at 200 in glass.

1042 -
2 oz weak Ni 6 oz NaOH reg process
treated 6 oz Double Hfsalt —
put in gold 310, no graphite —
Grid soaked in Silvering solution
& dried & resoaked & dried 4 times
then put in Cell — Rochelle acid
Solution —

(2 ok)
1043 - a Regular charged
24 hours then put in water
for 1 or 2 hours & then
Reversed and run in Water
~~hours changing~~ changing
the water every 2 or 3 hours
until it shows only traces
of KOH. Then ~~we~~ run until
Current will not pass,
then soaked in large amount
of water for 2 days & then run
Regular — KOH Charge discharge

1044 — Regular Charged 24 hours — Nickel Taken out & put in large bottle with distilled water & kept warm & water changed from time to time until no alkaline reaction then put in & Run Regular in 21% KOH.

1045 — Regular put in water only & charged the KOH in nickel beaker sufficient to give conductivity — then water changed & Charged steel further until revolutions gets too high then removed from little bottle & — Soak in large jar in water until no alkaline reaction — then put in little bottle & Run Regular in 21% KOH.

1046 2/7/04

71 RQ

$MnOH_2$ & Together with $MnOH_2$
5% $MnOH_2$

a

8 & 2 fine graphite wet H_2O, wd 15 min.
3.2 cohe reg cell.

b

Same as (a) ch nowise in 5% liq
KOH. 12 hrs in glass.

1047 73 Ra.

$MnOH_2$ & $MnOH_2$ & for together
10% $MnOH_2$.

a

8 & 2. fine graphite wet H_2O wd 15 min.
3.2 cohe reg cell.

b

Same as (a) ch nowise in
liq 5% KOH 12 hrs in glass.

1048. R.A.

(a)
4.3 Gms. #1048 Ground fine.
1 cc. 2% KOH
H_2O to roll good.
Roll 20 min. Dry and make cake
3.7 Gms. Light Pure
Chge. rig as cell.

(B)
4.3 Gms. 1048 Ground fine.
1 cc 5% KOH
H_2O to roll go
Roll 20 min. Dry make cake 3.2 Light Pure
Chge. rig as cell.

(C). 4.3 Gms #1048 Ground fine
1 cc 10% KOH. H_2O to roll good
Rol. 20 min. Dry make cake 3.2 Light Pure
Chg. Rig as cell.

D 4.3 gms #1048 Ground fine
1 cc 15% KOH. H_2O to roll good
Roll 20 min. Dry make cake 3.2 Light
Press. Chg. rig as cell.

(E) 4.3 gms #1048 Ground fine
1 cc 21% KOH. H_2O to roll good.
Roll 20 min. Dry. make cake 3.2
Light Pure. Chg. rig as cell.

1048.

(F) 4.5 Gms. 1048 Fine ground.
1 cc. 20% KOH. H_2O to roll good.
500 Gms Coarse Graphite
Roll ete. same as (a)

(G) 4.5 Gms 1048 Fine
1 cc 5% KOH. H_2O to roll good
500 Gms Coarse Graph.
Roll ete. same as (a).

(H) 4.5 Gms 1048 Fine
1 cc 10% KOH. H_2O to roll good
500 Gms Coarse Graph.
Roll ete. same as (a)

(I) 4.5 Gms #1048 Fine
1 cc 15% KOH to roll good
500 Gms Coarse Graph.
Roll ete. same as (a)

(J) 4.5 Gms 1048 Fine
1 cc 21% KOH. H_2O to roll good
500 Gms Coarse Graph.
Roll ete. same as (a)
not enough stuff

1050 R.A. #70

Some #56 treated with 20% NaOH. then washed 3 times & treated with 15% for 3 days. washed free from Cl. Tested 3 washes with Ind. K.I.

a. I.
4.3 grms #1050
½ cc 21% KOH. Roll 20 min.
charge reg. as all.

b. I
4.3 grms #1050
½ cc 21% KOH Roll 20 min
charge reverse in 5% KOH hot 12 hrs in glass then charge direct
2 times.

C.
4.5 grms #1050.
.5 " Tenax ref.
½ cc 21% KOH Roll 20 min
charge reg. as all.

D. Duplicate of C.
Charge like B.

1051 R.A. #68.

Some of #56 treated with 4.3% KOH. washed twice then hydrated for 3 days & washed free from Cl & dried then made into quids same as 1050.

a
4.3 grms 1051
½ cc 21% KOH. Roll 20 min.
charge reg. as all.

B
4.3 grms 1051
½ cc 21% KOH Roll 20 min.
charge reverse in 5% KOH hot 12 hrs in glass then charge direct 24 hrs in all.

C.
4.5 grms 1051
.5 " Tenax ref.
½ cc 21% Bicarbonate Roll 20 min
charged as all.

D
Duplicate of C.
Charge like B.

1052. R.A.S.C.

95%. $Ni(OH)_2$ = 29.2 cc sol = 30 gms.
1.5 gms $Co(OH)_2$ = 3.5 gms K.C.O.

(a)
8 + 2 fine graphite wet 3 cc KOH 21%. ~~dry~~ Roll 15 min. Dry. 3.2 gm cake neg cell.

(b) Same as (a) chg. reverse 12 hrs in glass ~~wet~~ 10% KOH cold, 70 mins then dist 24 hrs in 21% in cell. ~~[illegible]~~

1053. A.S.C.

90% $Ni(OH)_2$ = 30 gms Dry.
3.3 gms = $Co(OH)_2$ = 10%
7.4 gms K2 CoO_4

(a) 8 + 2 fine graf. wet mixed 3 cc KOH 21% Roll 15 min. Dry. 3.2 gm cake neg cell.

(b) Same as (a) chg. reverse 12 hrs in glass in 10% KOH cold @ 750 rate then dist in 21% KOH in cell (24 hr) then run.

1054 R.A.

85% $Ni(OH)_2$ = 30 grms Dry.
15% CuOH/2 = 5.3 grms
11.9 grms K_2CrO_4

(a). 8 + 2 fine Graphite wet s. c. 22% KOH Roll 15 min. Dry. 3.2 gm cake Chipped as all.

(b) Same as (a) chg. reverse in 10% KOH cold in glass @ 750 rate, then direct in 21% in cell 24 hrs + rim.

1055 R.A.

a

8 + 2 fine graph. roll 15 min moist with 1 c.c. KOH 10% + H_2O to suit demand, dry & make cake 3.2.

b

8 + 2 coarse graph moist H_2O roll [illegible]

c

Same as (b) reverse 12 hrs in 10% KOH [illegible]

✓

1056.

3 gms #63 Reg in. ground fine.
1½ " x fine graph.
1 cc. 33% KOH. + H_2O to make right mixt.
Roll 20 min then add 1 gms coarse graph
+ roll 10 min dry powder = 23.8% graph.
+ make 3.3 gms dry. = (2.62 gms lab. O_2)
a) dr reg or cell. (begin exp. to fusion)

✓

(b)

Same as (a) dr reverse 24 hrs in 5% KOH.

✓ #1057.

~~2 gms~~ 7 gms #63 ground fine.
2 gms x fine graph.
1 cc. 33% KOH.
Roll 20 min + add ½ gm coarse graph +
roll 15 min. + dry

a

✓ 3.45 gms dry of above. dr + min reg

b.

✓ 3.45 gms dry dr 24 hrs reverse in 5% cell.

1058. R. L.

100 gms #1048 Ni + NH4Cl = 13 gms R. p.
½ cc NH4OH. =
suspension Paste + dried on glass plate.
(a) N. 3 gms #1058.
½ cc KOH 21%

1059 R. L.

1060 R.a

1061 R.a

1062 R.a

1063 R.a

1064 R.A.

1065 = Nickel precipitated with KOH containing Chromate K — & Sulphate Nickel both hot, Washed & dried — 842 pure graphite, Rolled wet with ½ percent KOH in the water rolled ten minutes 3.2 Cake —

#2195. 12/21/04

My explanation of the cause of slow falling off of capacity in cells is as follows -

1st Owing to concave footed a foot is stacked in the wall of the foot which is when it becomes nearly flat when there is not enough mechanical pressure to prevent the gas pressure from separating the cup more or less from the cake during charge where a deposit can slowly accumulate on the cup inside & prevent good contact when the elasticity of the steel brings the cup back on the cake after charging stops.
Each charge allows a little more of this deposit to accumulate.
The deposit may be the corrosion of the Ni plate due to weak potash & acid radicals also Fe_2O_3 Al_2O_3 & Mg_2O & organic
So pion of $Ni(OH)_2$ corrosion hints make good with cup having this deposit or clean by charging in weak KOH.

containing some KCl.
Tests made with these cups if they go bad will show that the only solution of the problem of prevention of loss of capacity lies in mechanical construction so that it will be impossible for the cake cup to get out of contact at all.
If the cup & cake never get out of contact the insulating deposit can never form.
The pressure of corrugating may break through the film formed with the test cups hence before coming to final conclusions it will be necessary to ascertain whether or not the film has been broken by making up the grid.

If the tests go bad see if ~~cups~~ reuse don't improve.

#2196.
$NiCl_2(H_2O)$ is made by precipitating 500 cc of $NiSO_4$ sol sp. gr. 1.157 by pouring into large excess of Na_2CO_3 sol washing by decantation

#2197 2/16/05

JBO grids are made of 3 gms flake Ni mounted with one neg & charged in 1½% KOH containing a very small quantity of KBr. the object being to so regulate the strength of KOH, so that the flake Ni made will be attacked & active Ni formed but with sufficient KOH to prevent the acid radical from attacking the cuf on the outside.

It is charged in this & then put in 21% KOH & charge neg & run neg.

#2198. 2/21/05

ie group of 5 Ni are made up with 3.2 gms of .004" pure nickel to be mounted with 2 Fe neg & charged in 1½% KOH containing 10 mg KBr to each cell. The idea being to form the active material by charging, if the grid blackens on outside it will be necessary to add more KOH.

Ch #8 has been ch 15 hrs in neg 21% & run.

Cells #3576 + #3577 are the same as above except for this difference, they were held to yellow heat in hydrogen before assembling the idea being to weld the cuf together & to the frame & the flake to the cuf.

2199.

#2174 (hyped carbonate Li) is heated in current of Hydrogen for 1½ hrs at 190°C in a cream bath.
The product was green but changed to a dark brownish grey on exposure to the air.

#2200 2/22/05

Tried to make nickel flake metal by passing Hydrogen over a mixture of fused $NiCl_2$ in $ZnCl_2$ at low red heat — say about 800° F.
Result his flake metal but an abundance of a sub chloride in this scales like graphite were formed, they were not soluble in hot water & could be separated perfectly from the $ZnCl_2$
They are transparent & almost colorless but when a mass of them are viewed they leave a greenish-brown yellow color
Treated with hot KOH they turn greenish & do not change shape or swell.
Mixed with calcium oxide powder & reduced by hydrogen at bright red they are reduced to fine flakes of metal without change of shape.
The CaO is removed by water followed by dilute HCl.

2201.

The micaceous nickel chloride of 2200 is cooled in ingot iron of K over night.
Result is prismatized his in laminae much resembling graphite.
It is reduced by H_2O_2 to green transparent scales.
The prismatized is a poor conductor of electricity but is nevertheless a conductor.

2202.

The micaceous his chloride of 2200 is treated to K_2S dry in tube, it get hot & changes to sulphide & when more strongly heated chloride but still has the laminar structure & is a good conductor almost as good as graphite.

#2203 2/27/03

$Ni(OH)_2$ Reduced by Hydrogen
at 400° 5 lb #. 20
simmer to about ½ of original vol.

60
.05
2.50

18.5

25 / 1420

#2204. 2.5

Nickel acetate neutralized by
ammonia has a little of a sol
of egg albumen added & some
H_2O_2 - this converts the whole
into foam which was dried
roasted & reduced by the 5 lb Hydrogen.

292 | 30 / 10 — 10 | 520 / 50 — 50

1. 2½ — 4½

60 | 25 — 2.4

100 — 2 — 24

20
30 — 60
45 | 16 — 4
22 — 28 — 240
130

1100.0 — 925 — 175.0 — 165 — 6

1.6 — 300 — 480.0

45 — 16 — 5.4

280 — 1.6

16 80
2 80
448.0

448
450
898 | 177 — 8.6
17 — 13 — 6.4
128 — 2.2
237

13
5
45